

THE LONG DURATION EXPOSURE FACILITY (LDEF) ANNOTATED
BIBLIOGRAPHY

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A major objective of the Space Act of 1958 which led to the establishment of the National Aeronautics and Space Administration (NASA) was the dissemination of science and technology. Today, under NASA administrator Daniel Goldin and the White House, there is a reemphasis on the dissemination and transfer of NASA science and technology to U.S. industry: both aerospace and non aerospace. The goal of this transfer of science and technology is to aid the U.S. industry making them more competitive in the global economy.

After 69 months in space, LDEF provided new and important information on the space environment and how this hostile environment impacts spacecraft materials and systems. The space environment investigated by the LDEF researchers included: ionizing radiation, ultraviolet radiation, meteoroid and debris, atomic oxygen, thermal cycling, vacuum, microgravity, induced contamination and various synergistic effects. The materials used as part of LDEF and its experiments include polymers, metals, glass, paints and coatings. Fiber optic, mechanical, electrical, and optical systems were also used on LDEF.

Approximately 1161 pre- and post-retrieval LDEF publications and papers have been published to date. Published LDEF papers have been written in several languages, including English, French, and German. These papers have appeared in the world's scientific journals, including *Nature*, and in three NASA published LDEF Post-Retrieval Symposium volumes. A partial list of the scientific journals containing LDEF papers is given in Table 1. A total of 132 papers appeared in the first LDEF Post-Retrieval Symposium volume (ref. 1), and 112 papers appeared in the second LDEF Post-Retrieval Symposium volume (ref. 2). The third LDEF Post-Retrieval Symposium volume is in preparation and will contain over 100 papers when it is published in late 1994 (ref. 3).

As part of the effort to disseminate and transfer LDEF science and technology, an annotated bibliographic database is being developed. This bibliography will be available electronically, as well as in hard copy. All LDEF domestic and foreign publications in the open literature, including scientific journals, the NASA LDEF Symposia volumes, books, technical reports and unrestricted contractor reports will be included in this database. The hard copy, as well as the electronic database, will be categorized by section in the scientific and technical discipline. For example, all LDEF papers dealing with ionizing radiation will appear as a stand alone database. All LDEF materials papers will also appear as a stand alone database. Within each individual subject database, there will be further divisions by category. For example, in the LDEF materials database, all polymer papers will be grouped; all metals will be grouped and further subdivided by the particular species of metal. By publishing each LDEF discipline database as a separate unit, information will be disseminated more quickly to the user community. Each LDEF

reference will include the following information: title, author(s) name, publication name, volume, date, page, abstract. and NASA RECON number.

A sample entry follows:

The Distribution of Debris Impacts Over Satellite Surfaces With Special Regard
to the Long Duration Exposure Facility LDEF
Zhang, J.
Rex, D.
Zeitschrift fuer Flugwissenschaften und Weltraumforschung
Vol. 17 No. 3
1993
170-180

Examination of surfaces recovered from space indicates a high flux of small particles of natural as well as manmade origins. In this paper, a model of small orbital debris particles is presented and impact distributions resulting from this model are derived and discussed. In order to understand the observed impacts on LDEF, general relationships between particle orbits and crater distributions over the LDEF surfaces are analyzed. After comparison of modeling results with observational data, a modification of the debris model is proposed which fits the measurement favorably.

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The compilation of LDEF papers can be updated periodically and converted into Space Environment and Effects (SEE) bibliographic publications and databases (ref. 4). Thus, researchers, environment modelers, and spacecraft designers may access a readily available database of previous findings on the space environment and its effects on materials, systems, and spacecraft. The third post-retrieval symposium contained papers on EOIM-3, Mir, and EURECA. Those papers will be integrated in the respective databases for their disciplines. For example, the Benton and Frank paper on radiation results on EURECA (ref. 5) will appear in the radiation volume and database. Therefore the database will cover references from other spacecraft and experiments.

This author asks that you assist in the development of the SEE database by sending her a list of your LDEF publications and a list of SEE related publications.

References

1. Levine, A. S. (Editor): 69 Months In Space: The First LDEF Post-Retrieval Symposium. Volumes I, II, and III. NASA Conference Publication, NASA CP-3134, 1991.
2. Levine, A. S. (Editor): 69 Months In Space: The Second LDEF Post-Retrieval Symposium. Volumes I, II, III, and IV. NASA Conference Publication, NASA CP-3194, 1992.
3. Levine, A. S. (Editor): 69 Months In Space: The Third LDEF Post-Retrieval Symposium. Volumes I, II, and III. NASA Conference Publication, NASA CP-3275, 1995.

4. Bowles, David E. , Robert L. Calloway, Joan G. Funk, William H. Kinard, Arlene S. Levine, From LDEF to a National Space Environments and Effects (See) Program: A Natural Progression, NASA CP-3275, 1994.
5. Preliminary Results of Radiation Measurements on EURECA, E.V. Benton, A.L. Frank, NASA CP-3275, 1995.

Table 1. Some Journals and Proceedings Containing LDEF Papers

Journals

Advances in Space Research
 Applied Optics
 Geophysical Research Letters
 Icarus
 Journal of Geophysical Research
 Journal of Materials Science
 Journal of Spacecraft and Rockets
 Luft und Raumfahrt
 Nature
 Scripta Metallurgica et Materialia
 Zeitschrift fuer flugwissenschaften und Weltraumforschung

Conference Proceedings

American Astronautical Society (AAS)
 American Institute for Aeronautics and Astronautics (AIAA)
 Committee on Space Research (COSPAR)
 Composite Materials Conference
 European Space Agency (ESA) Conferences
 European Symposium on Spacecraft Materials in Space
 International Astronautical Conference
 International Conference on Engineering, Construction, and Operations in Space
 International Conference on Fourier Transform Spectroscopy
 International Instrumentation Symposium
 International SAMPE Conferences
 International Society for Optical Engineering
 LDEF Materials Workshops
 LDEFSymposia
 Lunar and Planetary Science Conferences, Lunar and Planetary Institute
 Meteoritical Society
 NASA/SDIO Space Environmental Effects on Materials Workshop
 Space Flight Mechanics Conferences
 Symposium on Chemical Evolution and the Origin of Life
 Symposium on Shuttle Small Payloads

